DECOMMISSIONING PLAN FOR LICENSE SUB-1435

JEFFERSON PROVING GROUND

MADISON, INDIANA

U.S. Department of the Army
Soldier and Biological Chemical Command
5183 Blackhawk Road
Aberdeen Proving Ground, MD 21010-5424

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Final

DECOMMISSIONING PLAN FOR LICENSE SUB-1435

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MADISON, INDIANA

Submitted to:

Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
Washington, D.C.

Prepared by:

U.S. Department of Army
Soldier and Biological Chemical Command
Aberdeen Proving Ground, Maryland

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ACRONYMS AND ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act of 1990
ALARA	as low as reasonably achievable
Am	americium
ANG	Air National Guard
ANSI	American National Standards Institute, Inc.
AR	Army Regulation
ARPA	Archeological Resources Protection Act
BGS	below ground surface
BLM	Bureau of Land Management
Bq	becquerel
Bq/kg	becquerel per kilogram
BRAC	Base Realignment and Closure Act of 1988
^{o}C	degrees Celsius
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERFA	Community Environmental Response Facilitation Act of 1992
CFR	*Code of Federal Regulations*
cfs	cubic feet per second
cm	centimeter
cm/sec	centimeters per second
cm^2	square centimeter
COC	chemical of concern
cpm	counts per minute
Cs	cesium
DCGL	Derived Concentration Guideline Limit
DEIS	Draft Environmental Impact Statement
DOE	U.S. Department of Energy
DP	Decommissioning Plan
dpm/cm^2	disintegrations per minute per square centimeter
dpm/g	disintegrations per minute per gram
DU	depleted uranium
E	Endangered
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ERM	Environmental Radiation Monitoring
^{o}F	degrees Fahrenheit
FE	Federally Endangered
FONSI	Finding of No Significant Impact

ACRONYMS AND ABBREVIATIONS (Continued)

FS	Feasibility Study
FT	Federally Threatened
ft	foot or feet
ft^3	cubic feet
FWS	U.S. Fish and Wildlife Service
GDP	Gaseous Diffusion Plant
GPR	ground-penetrating radar
HE	high explosive
HPP	Health Physics Program
IANG	Indiana Air National Guard
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
ISDH	Indiana State Department of Health
in.	inch
INEEL	Idaho Engineering and Environmental Laboratory
INSC	Indiana Special Concern
IRP	Installation Restoration Program
JPG	Jefferson Proving Ground
kBq/kg	thousand becquerel per kilogram
keV	kiloelectron volt
kg	kilogram
km	kilometer
km^2	square kilometers
KSNPC	Kentucky State Nature Preserves Commission
KYE	Kentucky Endangered
KYSC	Kentucky Special Concern
LANL	Los Alamos National Laboratory
m	meter
m^3	cubic meters
m^3/sec	cubic meters per second
meV	megaelectron volt
MMI	Modified Mercalli Intensity
MOA	Memorandum of Agreement
mrem/yr	millirem per year
MW	Monitoring Well
MWH	Montgomery Watson Harza
MWS	Missile Warning System
NA	not applicable
NAGPRA	Native American Graves Protection and Repatriation Act of 1990

ACRONYMS AND ABBREVIATIONS (Continued)

NaI	sodium iodide
NCDC	National Climatic Data Center
NCSHPO	National Conference of State Historic Preservation Officers
NE	Northeast
NHPA	National Historic Preservation Act of 1966
NIST	National Institute of Standards and Technology
NMSS	Office of Nuclear Material Safety and Safeguards
NOI	Notice of Intent
Np	neptunium
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NW	Northwest
NWR	National Wildlife Refuge
Pa	protactinium
pCi/g	picocuries per gram
pCi/L	picocuries per liter
ppb	parts per billion
ppm	parts per million
Pu	plutonium
R	Rare
RAB	Restoration Advisory Board
RAI	request for additional information
RCCCD	Radiologic, Classic, and Clinical Chemistry Division
RESRAD	Residual Radiation
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
RSO	Radiation Safety Officer
Rust E&I	Rust Environment and Infrastructure
S	South
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act of 1986
SBCCOM	Soldier and Biological Chemical Command
SEG	Scientific Ecology Group
SER	Safety Evaluation Report
SHPO	State Historic Preservation Officer
SRP	Standard Review Plan
STOLS	Surface Towed Ordnance Locater System
STV	Save the Valley

ACRONYMS AND ABBREVIATIONS (Continued)

SVOC	semivolatile organic compound
T	Threatened
TACOM	Tank-Automotive and Armaments Command
Tc	technetium
TEDE	total effective dose equivalent
Th	thorium
TRU	transuranic
U	Uranium
UNEP	United Nations Environmental Programme
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAEC	U.S. Army Environmental Center
USAF	U.S. Air Force
USATSDR	U.S. Agency for Toxic Substances and Disease Registry
USDA	U.S. Department of Agriculture
USDHHS	U.S. Department of Health and Human Services
USGS	U.S. Geological Survey
UXO	unexploded ordnance
VOC	volatile organic compound
WHO	World Health Organization
WL	watch list
µm	micrometer
µR/hr	microroentgen per hour
µrad/hr	microrad per hour

1.0 INTRODUCTION

This Decommissioning Plan (DP) presents the U.S. Army's request for termination of its license SUB-1435 for possession of depleted uranium (DU) at the Jefferson Proving Ground (JPG) under restricted conditions and is a revision of the DP submitted on June 30, 2001, in response to Nuclear Regulatory Commission (NRC) comments received via letter dated September 27, 2001 (NRC 2001). U.S. Army Soldier and Biological Chemical Command (SBCCOM), Aberdeen Proving Ground, Maryland, is the organization responsible for this license. This DP presents background information, assessments, and commitments to support this license termination request.

Section 1.1 of this introduction describes the site. Sections 1.2 to 1.3 highlight the licensed activities and nature and extent of contamination. The decommissioning objective is presented in Section 1.4. A summary of the dose assessment and as low as reasonably achievable (ALARA) analysis (Sections 1.5 and 1.6) provides the basis for the restrictions used to limit doses (Section 1.7). Public participation activities (Section 1.8) also are summarized. Finally, the proposed initiation and completion dates and request for license termination are stated in Sections 1.9 and 1.10. Section 1.11 identifies the organization of this DP.

1.1 SITE DESCRIPTION

JPG was established in 1941 as a proving ground for the test firing of a wide variety of ordnance. The facility is approximately 55,264 acres [224 square kilometers (km^2)] and is located in Jefferson, Jennings, and Ripley Counties in southeastern Indiana. A firing line with 268 gun positions used for testing ordnance separates JPG into two areas: a 4,000-acre (16.1-km^2) southern portion and a 51,000-acre (206-km^2) northern portion [Science Applications International Corporation (SAIC) 1997a].

The U.S. Army used JPG as a proving ground from 1941 to 1994. During this time, more than 24 million rounds of conventional explosive ammunition were fired. Approximately 1.5 million rounds did not detonate upon impact, remaining as high explosive (HE) unexploded ordnance (UXO) either on or beneath the ground surface. In addition, the Army estimates that 7 million inert filled rounds with live detonators, primers, or fuzes did not function properly. This remaining UXO and its hazard has been a major factor in decisions about managing the area north of the firing line (SAIC 1997a).

1.2 SUMMARY OF LICENSED ACTIVITIES

As part of its munitions testing program, the JPG test fired DU projectiles. The DU test firings were conducted under a license issued by the NRC (License SUB-1435, Docket 040-08838) [Appendix B]. The test firing of DU projectiles occurred between 1983 and 1994.

The DU projectiles were fired from three fixed-gun positions on the firing line at soft (cloth) targets placed at intervals of 3,280 feet (ft) [1,000 meters (m)], starting at 3,280 ft (1,000 m) from the gun position and continuing to 13,123 ft (4,000 m). Because of the type of testing performed, the DU projectiles would impact in approximately the same location each time on their respective line of fire. This firing protocol, with repeated impacts in the same area, resulted in the formation of a trench approximately 3.4 ft (1 m) deep by 16.4 to 26.3 ft (5 to 8 m) wide extending for approximately 3,937 ft (1,200 m) at the most frequently used gun position [Scientific Ecology Group (SEG) 1996].

The primary impact location was the trench. Secondary impact locations developed when the projectile skipped, either whole or in fragments. A similar pattern was repeated at each of the other two firing

positions but to a lesser extent because a smaller quantity of DU was fired from each of these locations (SEG 1996).

Approximately 220,462 pounds [100,000 kilograms (kg)] of DU projectiles were fired at soft targets in a 2,080-acre (8.4-km^2) DU Impact Area. This surface recovery occurred semiannually when the installation was operational and resulted in removal of most of the DU projectiles located on the ground surface. Approximately 66,139 pounds (30,000 kg) of DU projectiles and projectile fragments were recovered. Approximately 154,323 pounds (70,000 kg) of DU remain in the DU Impact Area (SEG 1995, 1996). Removal of the remaining DU would be extremely difficult, posing high risks to workers and costing $45 million to $1.6 billion because of the necessity to complete surface and subsurface remediation in the presence of UXO (see Section 7.0).

The JPG was closed in September 1995 under the Defense Authorization Amendments and Base Realignment and Closure Act of 1988 (BRAC). At this time, the area south of the firing line, where DU was stored, was surveyed to determine the extent of DU contamination. Any contaminated areas were decontaminated, and the total area south of the firing line was released for unrestricted use in 1996. The NRC license for the area north of the firing line was amended for possession of DU only in May 1996.

1.3 NATURE AND EXTENT OF CONTAMINATION

There is an estimated 154,323 pounds (70,000 kg) of DU in the DU Impact Area. The distribution of this DU is non-homogeneous because of the variability in the projectile trajectory and projectile fragmentation. The initial non-homogeneous deposition of DU as metal remains non-homogeneous as the DU metal oxidizes with time. The highest concentrations of DU in the soil have been from samples taken directly under projectiles or projectile fragments. In these cases, the DU concentration in the soil in the top 5.9 inches (in.) [15 centimeters (cm)] under a penetrator or penetrator fragment can be thousands of picocuries per gram (pCi/g). The DU concentrations decrease with depth, and at depths greater than about 2 ft (61 cm), DU concentrations are comparable to background (SEG 1995, 1996).

Site surveys that have measured DU contamination without disturbing the surface have indicated that most of the contamination is along the firing lines. This surface characterization effort has identified an area of about a hundred acres that would require remediation if the DU Impact Area were to meet the criteria for license termination without restrictions. In actuality, a larger area would have to be investigated and remediated because of the uncertainty about the distribution of the DU projectiles and fragments (SEG 1995, 1996).

Random soil sampling programs have shown that the soil concentration typically is near background (about 2 pCi/g) with a few locations being 10 or 100 times background. No, or only minimal, DU contamination has been detected from environmental sampling of surface and groundwater, stream sediment, vegetation, and wildlife (Ebinger and Hansen 1996; SEG 1995, 1996).

Based on this understanding of the nature and extent of contamination, the radionuclides of concern, as a result of licensed activities, are the DU. Other potential radiological contaminants, such as plutonium, technetium, or americium, are negligible contributors to overall dose (see Appendix C for additional detail). DU is distributed non-homogeneously. The highest DU concentrations are in locations where projectiles or projectile fragments came to rest and are now corroding at an unknown rate. Additional characterization to understand the physical distribution of the DU would require UXO detection and removal and pose an imminent personnel safety hazard. The size of the area requiring UXO removal before a complete assessment of the nature and extent of DU contamination could be 200 to 400 acres (0.81 to 1.6 km^2).

1.4 SELECTED DECOMMISSIONING OBJECTIVE

The selected decommissioning objective is license termination with restrictions in compliance with the requirements of 10 *Code of Federal Regulations* (*CFR*) 20.1403. The selection of this objective for decommissioning and license termination was made after considering decontamination and license termination without restrictions (10 *CFR* 20.1402), as well as the selected decommissioning objective. The license termination with restrictions was selected for the following reasons:

- It is compatible with current use plans for the JPG property, specifically the maintenance of the Big Oaks National Wildlife Refuge (NWR) and the use of portions of the JPG property for bombing practice by the Indiana Air National Guard (IANG).

- The Army has institutional controls in place that define access and land use restrictions for the area North of the Firing Line, in general, because of the UXO hazard. Additional access and land use restrictions for the DU Impact Area (Section 16.0).also are defined. These institutional controls currently are the responsibility of the U.S. Fish and Wildlife Service (FWS) and U.S. Air Force (USAF) through the IANG (hereafter referred to as USAF/IANG) in accordance with a Memorandum of Agreement (MOA) [U.S. Army 2000a, b, and c]. If the MOA expires or one or more of these parties terminates the agreement, the U.S. Army, as the holder of the deed title, would be responsible for the institutional controls (see Appendix A).

- The Army has committed to request the necessary annual funding for the maintenance and implementation of institutional controls necessary to support license termination under restricted conditions (Section 15.0).

- The proposed institutional controls are legally enforceable and provide reasonable assurance that the total effective dose equivalent (TEDE) from residual DU radioactivity distinguishable from background to the average member of the critical group will not exceed 25 millirem per year (mrem/yr) if the institutional controls remain in place (Section 5.0).

- Residual radioactivity at the site is such that if institutional controls were no longer in effect, there is reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group is ALARA and would not exceed 100 mrem/yr (Section 5.0).

- The residual DU activity is consistent with ALARA because of the high costs of UXO and DU detection, removal, and disposal and the small benefit that would result from the cleanup of an approximately 2,080-acre (8.4-km^2) area inside the 51,000-acre (206-km^2) portion of JPG where UXO is present and is used for bombing practice. The ALARA analysis also indicates that decontamination of the DU Impact Area to meet the criteria for unrestricted use likely would result in "net public or environmental harm" (Section 7.0).

1.5 SUMMARY OF DOSE ANALYSIS

To assess compliance with the criteria for license termination with restrictions, two sets of exposure scenarios were developed and analyzed based on the estimated DU concentration in the environment. The first set of exposure scenarios is for the situation where institutional controls function as intended. These scenarios address members of the public at off-site locations, members of the public who use the Big Oaks NWR, and the FWS, USAF/ IANG, and U.S. Army workers at the site. The second set of exposure scenarios addresses the possible situation where institutional controls were no longer in effect.

This second set of scenarios includes a very conservative resident farmer. The exposure scenarios consider (1) information on the nature and distribution of DU contamination, (2) site-specific parameters for DU environmental transport processes, and (3), for the first set of scenarios, the proposed institutional controls.

For the scenarios where institutional controls are in place, the limiting average member of the critical group is an off-site industrial worker. The peak of the mean TEDE for this individual is calculated to be 16.6 mrem/yr using a high (conservative) average DU soil concentration of 225 pCi/g. This is below the limit of 25 mrem/yr TEDE. These results are summarized in Section 5.0 of this Decommissioning Plan (DP). Details of the associated calculations are presented in Appendix C. The population dose that will result based on institutional controls to limit public exposure also is estimated.

The scenarios for the situation where institutional controls are not in place also were analyzed. Because of uncertainty over the DU distribution, different combinations of DU concentrations in soil and different soil properties were evaluated. The resident farmer scenario without irrigation was identified as the limiting average member of the critical group. The peak of the mean TEDE for this individual is calculated to be 37 mrem/yr using a high (conservative) average DU soil concentration of 225 pCi/g. This is below the limit of 100 mrem/yr. These results are also summarized in Section 5.0 of this DP. Details of the associated calculations are presented in Appendix C.

1.6 SUMMARY OF ALARA ANALYSIS

An ALARA analysis was conducted according to the principles identified in the Office of Nuclear Material Safety and Safeguard's (NMSS's) Decommissioning Standard Review Plan (NRC 2000). This analysis identified and quantified, to the extent practical, the benefits and costs of decontaminating the DU Impact Area to meet license termination criteria for unrestricted use. The analysis indicated that small benefits would accrue from UXO and DU removal. Given that there is a potential for UXO to be present throughout the area North of the Firing Line, the remediated area would be surrounded by UXO and continue to pose risks to visitors or workers in the area.

The costs of UXO and DU detection and removal from the DU Impact Area also were estimated. The uncertainty associated with these costs is attributable to remediation technology limitations and insufficient knowledge of the depth and location of DU projectiles and fragments. These uncertainties are recognized in the ALARA analysis.

Based on the ALARA analysis, it was determined that the cost of decontamination is much larger than the benefits; therefore, the existing DU concentrations are consistent with ALARA. The analysis also indicates that decontamination of the DU Impact Area would result in net public and environmental harm.

1.7 RESTRICTIONS USED TO LIMIT DOSES

The U.S. Army will retain title to the property and impose access and land use restrictions to ensure that doses to the average member of the critical group are less than 25 mrem/yr. The Army has and will grant permits to other Federal agencies for use of the portion of the JPG North of the Firing Line when uses are consistent with the Army's commitments to the NRC.

At the present time, the Army has issued permits to the FWS for establishment and management of the Big Oaks NWR (~50,000 acres) and to the USAF (~1,087 acres, which are not part of the Big Oaks NWR) for use as a bombing range. These permits are presented in Appendix A of this DP. The Army will monitor these agencies for compliance with the terms of these permits.

This DP includes the U.S. Army's Statement of Intent to request the funds necessary for the maintenance and implementation of the institutional controls necessary to meet the criteria for license termination with restrictions.

1.8 SUMMARY OF PUBLIC PARTICIPATION ACTIVITIES

The Army has an ongoing public involvement program at JPG (SAIC 1997b). In support of this program, a Restoration Advisory Board (RAB) was established. The RAB is an advisory organization composed of local citizens and staff from involved federal and state agencies. The RAB is used as a forum for providing the community with an opportunity to identify concerns and participate in the Army's decision-making process. Numerous RAB meetings have been held since 1994, when the RAB was established, to discuss the installation closure and environmental restoration issues, including plans for management of the DU Impact Area.

The major issue raised by the public during these meetings has been the uncertainty about future doses to off-site individuals if the license were terminated and institutional controls were used to limit public exposure to DU contamination. The dose analysis, presented in Appendix C, addresses this issue.

1.9 PROPOSED INITIATION AND COMPLETION DATES

The U.S. Army proposes that the license be terminated upon NRC approval of this DP. The DP process for JPG, anticipated to be completed over the next 6 years, will involve the following major steps:

- **Acceptance Review** - The objective of the NRC's acceptance review is to verify that JPG's application is complete before an in-depth technical review is initiated. In addition, a limited technical review is conducted to identify significant technical deficiencies at an early stage, thereby precluding a detailed technical review of a technically incomplete submittal. At the conclusion of the acceptance review, JPG's DP will either be accepted for detailed technical review or rejected and returned to the licensee with the deficiencies identified. This phase of the process is approximately 60 days in duration.
- **Technical Review** – The NRC review of the JPG DP for license termination under restricted release conditions will be conducted in two phases. The first phase of the review will focus on the financial assurance and institutional control provisions of the DP. The review of the remainder of the DP will be initiated only after NRC is satisfied that the U.S. Army's proposed financial assurance and institutional control provisions will comply with the requirements of the License Termination Rule (10 *CFR* 20, Subpart E). The applicable portions of NUREG-1727 will be used to guide this phase of the review. Phase II of the review addresses all other sections of the technical review under NUREG-1727 and includes the development of an environmental impact statement (EIS). Therefore, one of the first steps in Phase II is the NRC's publication of a Notice of Intent (NOI) to develop an EIS. The basic EIS development steps that the NRC will implement include:
  - NOI;
  - public scoping meeting and scoping report;
  - preparation and publication of the draft EIS (DEIS);
  - public comment period on the DEIS, including a public meeting;
  - preparation and publication of the final EIS; and
  - preparation and publication of the Record of Decision (ROD).

  In parallel with the development of the EIS, the NRC will develop a draft and final Safety Evaluation Report (SER). The development of the draft SER will be coordinated with the development of the

DEIS so that any requests for additional information (RAIs) can be consolidated. This phase of the DP process is approximately 2 years in duration.

- **License Termination** - The DP process includes a step to complete decommissioning. For this license termination under restricted release conditions, decommissioning of the site is not planned. The U.S. Army's existing radiological surveys are proposed to fulfill NRC's required surveys. Furthermore, the U.S. Army demonstrates that the premises are suitable for release under restricted release criteria using the dose analysis presented in this plan. Once the NRC is satisfied that all decommissioning requirements are fulfilled, the license will be terminated by written notice to the U.S. Army when NRC determines that the information presented in this plan demonstrates that the DU Impact Area is suitable for release in accordance with the License Termination Rule.

1.10 REQUEST FOR LICENSE AMENDMENT

The U.S. Army requests that license SUB-1435 be terminated, subject to the commitments for institutional controls identified in this DP.

1.11 ORGANIZATION OF THIS DP

This DP includes the following sections:

- **Section 1.0. Introduction** – Provides an overview of the installation and operating history, and results of analyses; also states the U.S. Army's request for license termination with restrictions.
- **Section 2.0. Facility Operating History** – Describes the facility's operating history, including the licensed activities.
- **Section 3.0. Facility Description** – Details the site location, land use, socioeconomics, and existing environmental conditions.
- **Section 4.0. Radiological Status of the Facility** – Describes the radiological status of the facility, with emphasis on the DU Impact Area.
- **Section 5.0. Dose Modeling Evaluations** – Details and summarizes the dose modeling evaluations that are based on the risk analysis presented in Appendix C.
- **Section 6.0. Alternatives Considered and Rationale for the Chosen Alternative** – Presents the alternatives for license termination and the rationale for the selected alternative.
- **Section 7.0. ALARA Analysis** – Presents the ALARA analysis and includes the benefits and costs of decontamination of the DU Impact Area.
- **Section 8.0. Planned Decommissioning Activities** – Addresses any planned decommissioning activities.
- **Section 9.0. Project Management and Organization** – Describes the project management and organization, including the role and responsibilities of key organizations and personnel.
- **Section 10.0. Radiation Safety and Health Program During License Termination** – Describes the radiation safety and health program during license termination.
- **Section 11.0. Environmental Monitoring and Control Program** – Addresses the environmental monitoring and control program.

- **Section 12.0. Radioactive Waste Management Program** – Identifies the radioactive waste management program.
- **Section 13.0. Quality Assurance Program** – Describes the quality assurance program.
- **Section 14.0. DU Impact Area Radiation Surveys** – Specifies surveys to characterize the DU Impact Area.
- **Section 15.0. Financial Assurance** – Provides the U.S. Army's plan to ensure funding is available to support implementation of institutional controls.
- **Section 16.0. Restricted Use** – Provides the rationale and basis for license termination under restricted conditions under the provisions of 10 *CFR* 20.1402.
- **Section 17.0. References** – Details the references cited in this DP.
- **Appendices** – Four appendices support this DP and are noted below:

  Appendix A. Permits and Memorandum of Agreement

  Appendix B. NRC License SUB 1435

  Appendix C. Risk Analysis

  Appendix D. Statement of Intent

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2.0 FACILITY OPERATING HISTORY

In this section an overview of the facility's operational history is provided (Section 2.1). The license and operating history, with respect to DU operations, are summarized in Sections 2.2 and 2.3, respectively.

2.1 OVERVIEW

The Army's mission at JPG was to perform production and post-production tests of conventional ammunition components and other ordnance items and to conduct tests of propellant ammunition/ weapons systems and components. The base was closed in September 1995 under the BRAC.

The installation, located in southeastern Indiana (Figure 2-1), is divided into two areas separated by a firing line consisting of 268 gun positions formerly used for testing ordnance. An east–west fence, which is 7 ft (2.1 m), chain linked, and topped with V-shaped, three-strand barbed wire, separates the area north of the firing line from the cantonment area. The firing line demarcates the ordnance impact area to the north from the cantonment area to the south. The cantonment area houses the support facilities that were used for administrative ammunition assembly and testing, vehicle maintenance, and residential housing. The area north of the firing line consists of 51,000 acres (206 km^2) of undeveloped and heavily wooded land and contains the NRC-licensed area (SAIC 1997a). The DU Impact Area is located in the south-central portion of this area, as shown on Figure 2-2.

JPG was used as a proving ground from 1941 to 1994. During this time, more than 24 million rounds of conventional explosive ammunition were fired. Approximately 1.5 million rounds did not detonate upon impact, remaining as UXO either on or beneath the ground surface (U.S. Army 1995a). In addition, it is estimated that 7 million inert filled rounds with live detonators, primers, or fuzes did not function properly.

2.2 LICENSE HISTORY

Under NRC license SUB-1435, the Army tested DU projectiles and munitions from 1983 to 1994 (NRC 1996a). This testing was conducted in approximately a 2,080-acre (8.4-km^2) area located in the south–central portion of the installation, referred to as the DU Impact Area (Figure 2-1). During its 10-year use, more than 220,462 pounds (100,000 kg) of DU projectiles were fired into the DU Impact Area. Approximately 30,000 kg of DU have been removed. Approximately 154,323 pounds (70,000 kg) of DU remain in the DU Impact Area, which also contains one of the largest concentrations of UXO (SEG 1995, 1996; U.S. Army 1995a).

NRC license SUB-1435 was amended for possession of DU only in May 1996 (NRC 1996a) until license termination. Amendment 10 currently is in effect. NRC License No. 13-12416-01, for the use of scandium-46, was terminated in 1993. Other radionuclides were used under a general Army-wide license.

2.3 DU OPERATIONS

The DU projectiles (i.e., 105 and 120 mm DU rounds) were fired from three fixed gun positions on the firing line at soft (cloth) targets placed at intervals of 3,280 ft (1,000 m), starting at 3,280 ft (1,000 m) from the gun position and continuing to 13,123 ft (4,000 m). Because of the type of testing performed, the DU projectiles would impact approximately in the same location each time on their respective lines-of-

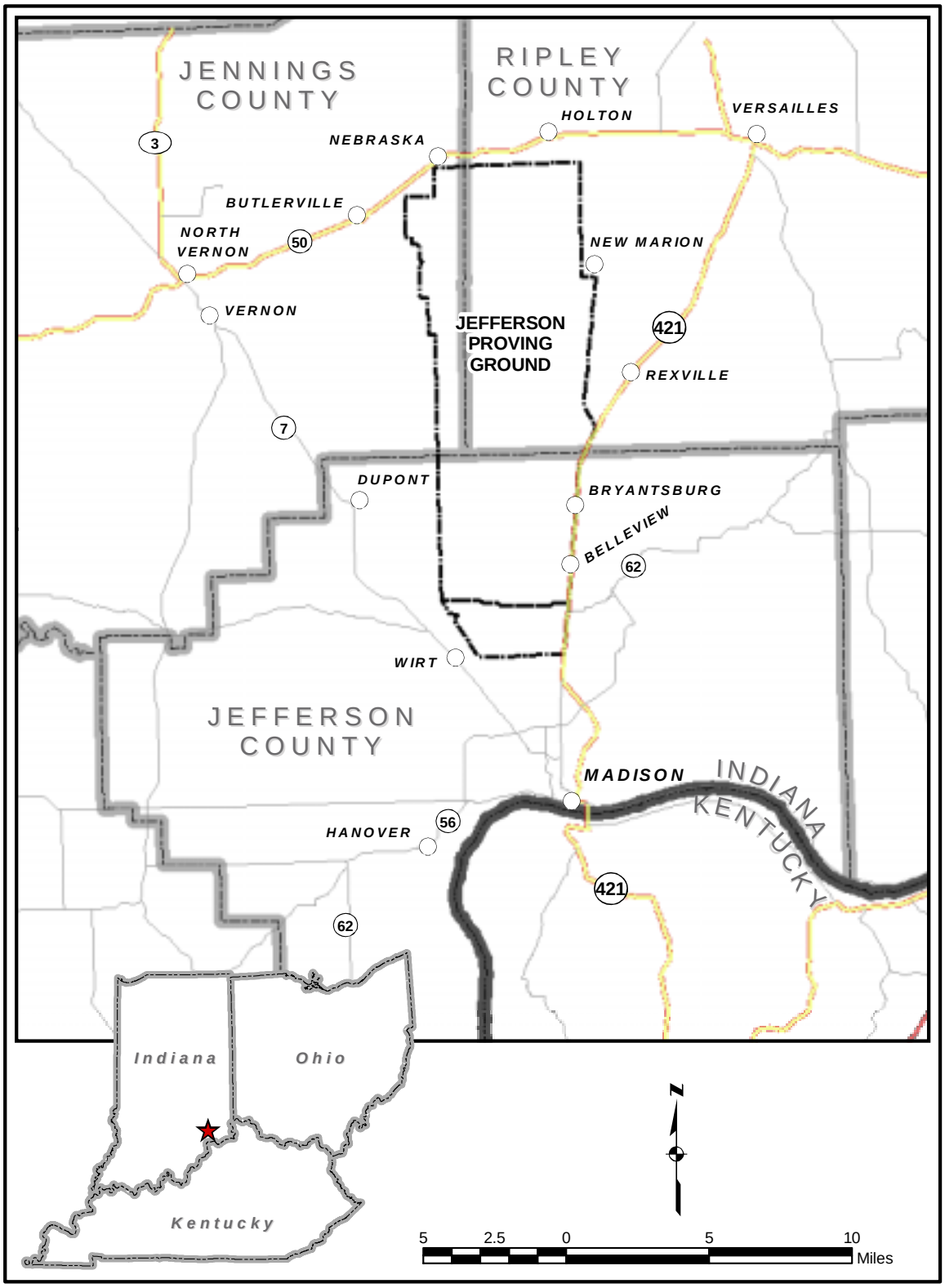

Figure 2-1. Regional Location of Jefferson Proving Ground

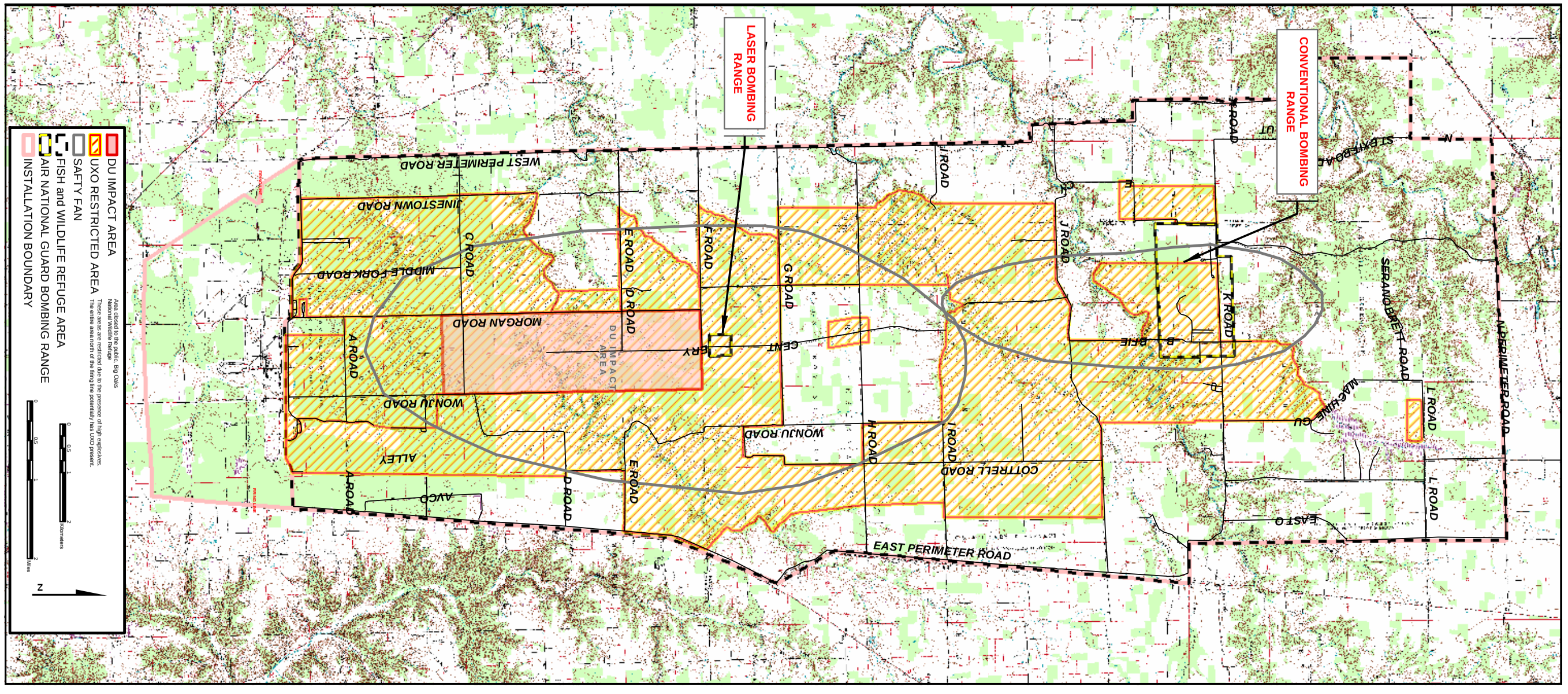

Figure 2-2. Jefferson Proving Ground, Indiana

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fire (SEG 1996). This firing protocol, with repeated impacts in the same area, resulted in the formation of a trench approximately 3.4 ft (1 m) deep by 16.4 to 26.3 ft (5 to 8 m) wide extending for approximately 3,937 ft (1,200 m) at the most frequently used gun position.

The primary impact location was the trench. Secondary impact locations developed when the projectile skipped, either whole or in fragments. A similar pattern was repeated at each of the other two firing positions but to a lesser extent and magnitude because a smaller quantity of DU was fired from each of these locations (SEG 1996).

The DU varies in size from microscopic particles to complete projectiles (SEG 1996). Other NRC-licensed activities at JPG included the storage of DU in buildings located in the cantonment area (Figure 2-3) of the installation (Buildings 186, 205, 216, 223, and 227). This portion of the site was released for unrestricted use by NRC action in 1996 to amend license SUB-1435. The Indiana State Department of Health, Division of Indoor and Radiological Health, concurred with the findings and recommendations for release of this latter area (NRC 1996b).

There is no historical or anecdotal evidence of spills, uncontrolled releases, or on-site burial of licensed material in the DU Impact Area.

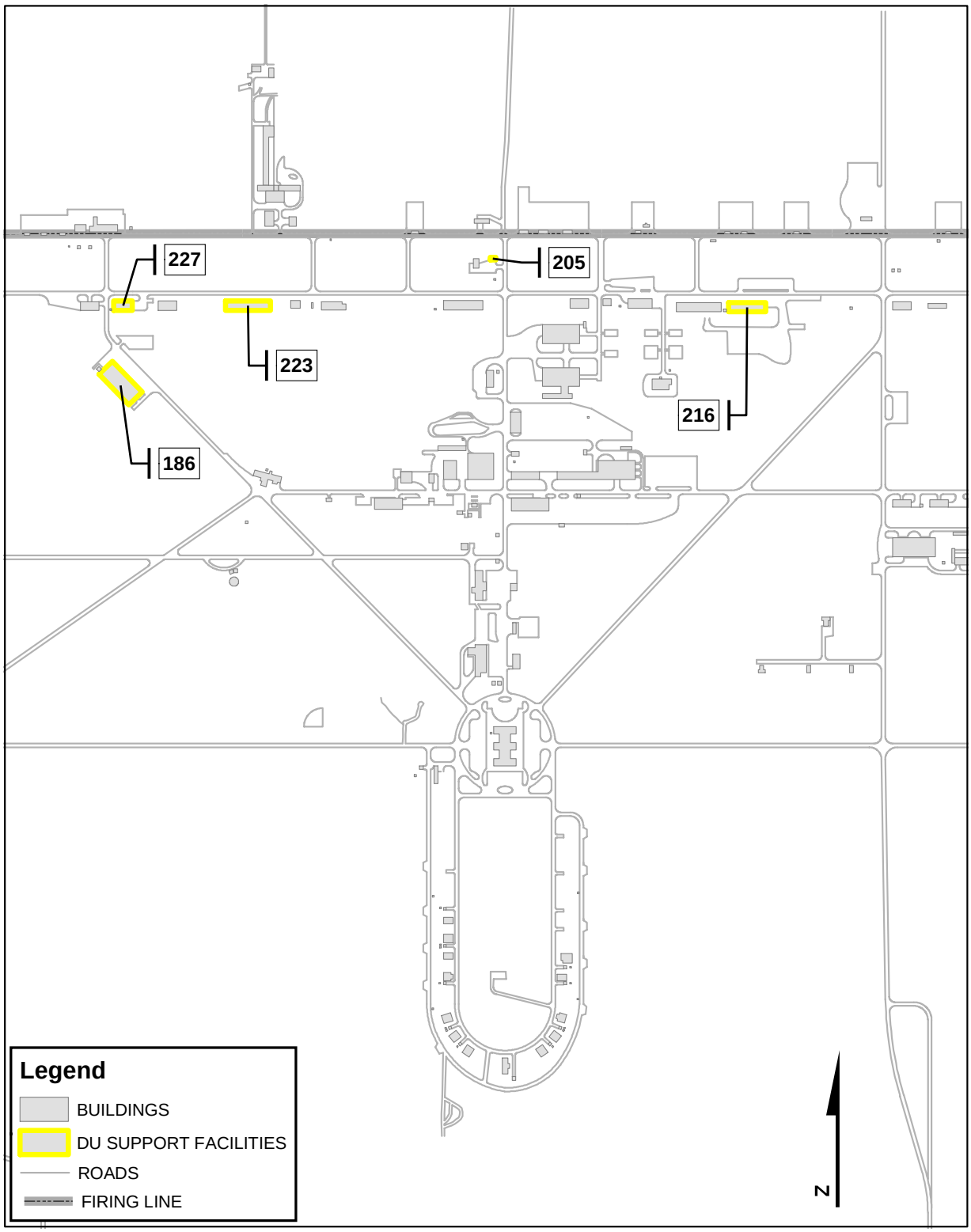

Figure 2-3. Location of DU Support Facilities in the Cantonment Area